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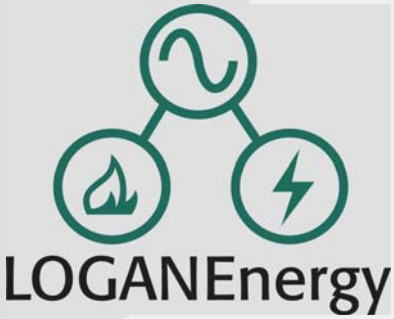

U.S. Army Engineer Research and Development Center,
United States Air Force Academy, Colorado Springs, Colorado
Initial Project Report

Proton Exchange Membrane (PEM) Fuel Cell Demonstration Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY04

Headquarters:

1080 Holcomb Bridge Rd
Suite 100-175
Roswell, GA 30076
Ph (770) 650-6388

U.S. Air Force Academy,
USAFA, CO 80840

August 26, 2005

California:

5680 Adobe Road
29 Palms, CA 92277
Ph (760) 367-5005

Executive Summary

Under terms of its FY'04 DOD PEM Demonstration Contract with ERDC/CERL, LOGANEnergy will install and operate a Plug Power GenSys 5kWe Combined Heat and Power fuel cell power plant (see Appendix section 2) at the U.S. Air Force Academy, CO. The site on the base selected for the one-year demonstration project is the Cadet Gymnasium. The unit will be electrically configured to provide grid parallel service to the site and it will also be thermally integrated with a building domestic hot water system. Local electrical and mechanical contractors may be hired to provide services as needed to support the installation tasks. It is anticipated that the project will reduce annual energy costs to the Academy by $131.04 during the period of performance. The initial Air Force Academy POC for this project was Thomas Hykes who may be reached at 719.333.8453, Thomas.hykes@usafa.af.mil. During the initial site visit, Tom introduced the new project POC as Diana Dean, USAFA Energy Manager (Contractor – JJ Maintenance, Inc.) who can be reached at 719.333.8398, Diana.Dean1@usafa.af.mil.

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Proposal – Proton Exchange Membrane (PEM) Fuel Cell Demonstration of Domestically Produced Residential PEM Fuel Cells in Military Facilities

1.0 Descriptive Title

United States Air Force Academy PEM Demonstration Project, United States Air Force Academy, Colorado Springs, Colorado

2.0 Name, Address and Related Company Information

LOGANEnergy Corporation

1080 Holcomb Bridge Road
BLDG 100- 175
Roswell, GA 30076
(770) 650- 6388

DUNS 01-562-6211
CAGE Code 09QC3
TIN 58-2292769

LOGANEnergy Corporation is a private Fuel Cell Energy Services company founded in 1994. LOGAN specializes in planning, developing, and maintaining fuel cell projects. In addition, the company works closely with manufacturers to implement their product commercialization strategies. Over the past decade, LOGAN has analyzed hundreds of fuel cell applications. The company has acquired technical skills and expertise by designing, installing and operating over 30 commercial and small-scale fuel cell projects totaling over 7 megawatts of power. These services have been provided to the Department of Defense, fuel cell manufacturers, utilities, and other commercial customers. Presently, LOGAN supports 30 PAFC and PEM fuel cell projects at 21 locations in 12 states, and has agreements to install 22 new projects in the US and the UK over the next 18 months.

3.0 Production Capability of the Manufacturer

Plug Power manufactures a line of PEM fuel cell products at its production facility in Latham, NY. The facility produces three lines of PEM products including the 5kW GenSys5C natural gas unit, the GenSys5P LP Gas unit, and the GenCor 5kW standby power system. The current facility has the capability of manufacturing 10,000 units annually. Plug will support this project by providing remote monitoring, telephonic field support, overnight parts supply, and customer support. These services are intended to enhance the reliability and performance of the unit and achieve the highest possible customer satisfaction. Vincent Cassala is the Plug Power point of contact for this project. His phone number is (518) 782-7700, and his email address is Vincent_cassala@plugpower.com.

4.0 Principal Investigator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	860.210.8050
Fax	770.650.7317	770.650.7317
Email	samlogan@loganenergy.com	kspitznagel@loganenergy.com

5.0 Authorized Negotiator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	860.210.8050
Fax	770.650.7317	770.650.7317
Email	samlogan@loganenergy.com	kspitznagel@loganenergy.com

6.0 Past Relevant Performance Information

a) Contract: PC25 Fuel Cell Service and Maintenance Contract #X1237022

Merck & Company
Ms. Stephanie Chapman
Merck & Company
Bldg 53 Northside
Linden Ave. Gate
Linden, NJ 07036
(732) 594-1686

Four-year PC25 PM Services Maintenance Agreement.
In November 2002 Merck & Company issued a four-year contract to LOGAN to provide fuel cell service, maintenance and operational support for one PC25C fuel cell installed at their Rahway, NJ plant. During the contract period the power plant has operated at 94% availability.

b) Contract: Plug Power Service and Maintenance Agreement to support one 5kWe GenSys 5C and one 5kWe GenSys 5P PEM power plant at NAS Patuxant River, MD. .

Plug Power
Mr. Scott Wilshire.
968 Albany Shaker Rd.
Latham, NY 12110
(518) 782-7700 ex 1338

c) Contract: A Partners LLC Commercial Fuel Cell Project Design, Installation and 5-year service and maintenance agreement on 600kW UTC PC25 power block.
Contract # A Partners LLC, 12/31/01

Mr. Ron Allison
A Partner LLC
1171 Fulton Mall
Fresno, CA 93721
(559) 233-3262

6.0 Host Facility Information

Congress authorized creation of the Air Force Academy in 1954. Harold E. Talbott, then secretary of the Air Force, appointed a commission to assist him in selecting the permanent site. After traveling 21,000 miles and considering 580 proposed sites in 45 states, the commission recommended three locations. From those, Secretary Talbott selected the site near Colorado Springs. The state of Colorado contributed $1 million toward the purchase of the property.

Construction began in 1955. The same year, the first class of 306 men were sworn in at a temporary site at Lowry Air Force Base, Denver. On Aug. 29, 1958, the wing of 1,145 cadets moved to its present site from Denver. Less than a year later the Academy received accreditation. On March 3, 1964, the authorized strength of the Cadet Wing was increased to 4,417 and later reduced to its present number of 4,000. Women entered the Air Force Academy for the first time on June 28, 1976. The first class with women graduated in May 1980.

Headquarters, United States Air Force Academy is supported by the 10th Air Base Wing. Located at the base of the Rampart Range on 18,500 acres; elevation is 7,163 feet above sea level at the Terrazzo level. Approximately one million visitors come to the Academy annually, including up to 7,000 people per day at the Visitor Center.

Cadets are housed in two dormitories, Vandenberg Hall (1,325 rooms) and Sijan Hall (936 rooms). Fairchild Hall contains classrooms, labs and faculty/staff offices (250 classrooms, 45 science labs, 13 lecture halls). Mitchell Hall dining area covers 1.7 acres; staff serves the entire cadet wing at the same time, in and out in only 25 minutes. The Air Force Academy Cadet Chapel is the 1996 recipient of the prestigious American Institute of Architects' (AIA) Twenty-five Year Award. Arnold Hall houses a 2,900-seat Broadway auditorium, ballroom, conference rooms, restaurant and historical displays. Athletic fields cover 143 acres and include 18 football fields, 13 soccer fields, and 10 flicker ball fields; all encompassing, 2,000 people can participate in sporting events at the same time. Cadet Field House includes the Clune Arena, used for basketball, boxing and public speaking events, seats 6,000. The Field House also has an indoor track, field area, and a hockey rink which seats 2,602. Cadet gym is five stories tall and contains

three basketball arenas, two pools (one Olympic size), 19 racquetball courts, weight rooms, four tennis courts, and offices.

7.0 Fuel Cell Site Information

On August 25, 2005, LOGAN representatives met with Thomas Hykes, Diana Dean, and Grazianno Del Col of the Academy to perform a site evaluation for the fuel cell project. As contemplated prior to the visit, the proposed site is building 8119, a fitness workout facility.
The fuel cell will be installed on the grassy area at the rear (south side) of the building, pictured at left. The building's natural gas service is located nearby on the outside wall (just to the left of the mechanical room double doors in the photo.)

9.0 Electrical System

The Plug Power GenSys 5C PEM fuel cell power plant provides both gird parallel and grid independent operating configurations for site power management. This capability is an important milestone in the development of the GenSys5 as it approaches product commercialization. The unit has a power output of 110/120 VAC at 60 Hz, and when necessary the voltage can be adjusted to 208vac or 220vac depending upon actual site conditions. At this site the unit will be connected to the facility in a grid parallel configuration dispatching power at 2.5 kW for most of the period of performance. The photo at right shows the electrical service where the fuel cell will be electrically coupled to the base utility grid. Selected circuits from the panel will be moved to a new sub-panel for circuits to be powered by the fuel cell during a grid outage. A 50 amp circuit breaker for connection of the fuel cell will utilize the panel slots vacated by the circuits moved to the sub-panel. The electrical closet is conveniently located behind the exterior wall adjacent to the fuel cell pad site.

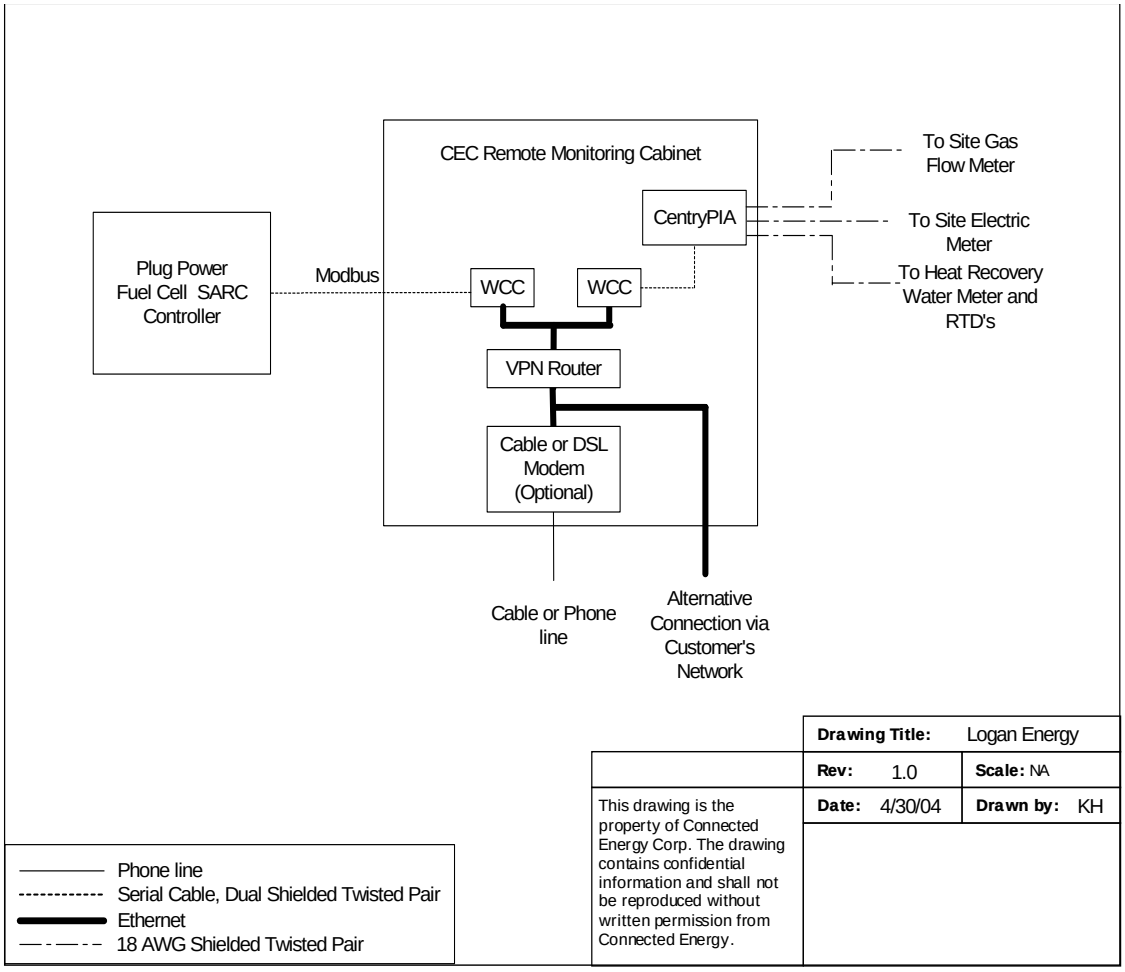
10.0 Thermal Recovery System

LOGAN proposes to integrate the fuel cell with the existing domestic hot water system. The DHW system includes the boiler (shown on the left side of photo), two large tanks (one tank partially visible at right side of photo), and a circulating pump (shown at bottom left.) Connection to the DHW system will be such that the fuel cell thermal energy will heat the system as much as possible; causing the existing boiler to be operated less.

11.0 Data Acquisition System

LOGAN proposes to install a Connected Energy Corporation web based SCADA system that provides high-speed access to real time monitoring of the power plant. The schematic drawing seen below describes the architecture of the CEC hardware that will support the project. The system provides a comprehensive data acquisition solution and also incorporates remote control, alarming, notification, and reporting functions. The system will pick up and display a number of fuel cell operating parameters on functional display screens including kWH, cell stack voltage, and water management, as well as external instrumentation inputs including Btus, fuel flow, and thermal loop temperatures. CEC's Operations Control Center in Rochester, New York maintains connectivity by means of a Virtual Private Network that will link the fuel cell to the center.

CEC WEB enabled SCADA terminal hardware.



LOGAN will procure Internet access to the fuel cell router from a local wireless, DSL, cable, or satellite service provider. The base will provide local dial tone to a phone jack that will be conveniently located in the nearby mechanical room to provide communications with the fuel cell data modem.

12.0 Economic Analysis

Camp Mabry ANGB

Project Utility Rates		
1) Water (per 1,000 gallons)	$	2.94
2) Utility (per KWH)	$	0.051
3) Natural Gas (per MCF)	$	5.09

First Cost		**Budgeted**	**Actual**
Plug Power 5 kW SU-1	$	65,000.00	
Shipping	$	2,400.00	
Installation electrical	$	5,375.00	
Installation mechanical & thermal	$	7,000.00	
Watt Meter, Instrumentation, Web Package	$	11,090.00	
Site Prep, labor materials	$	825.00	
Technical Supervision/Start-up	$	2,500.00	
Total	**$**	**94,190.00**	
Assume Five Year Simple Payback	$	18,838.00	$ -

Forcast Operating Expenses	Volume	$/Hr	$/ Yr	
Natural Gas Mcf/ hr @ 2.5kW	0.0330	$ 0.17	$ 1,324.28	
Water Gallons per Year	14,016		$ 41.21	
Total Annual Operating Cost				$ 1,365.48

Economic Summary			
Forcast Annual kWH		19710	
Annual Cost of Operating Power Plant	$	0.069	kWH
Credit Annual Thermal Recovery Rate	$	(0.012)	kWH
Project Net Operating Cost	$	0.0576	kWH
Displaced Utility cost	$	0.0510	kWH
Energy Savings (Cost)		($0.007)	kWH
Annual Energy Savings (Cost)		($131.80)	

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13.0 Kickoff Meeting Information

The USAFA project kick-off will occur on September 12, 2005. At that time, CERL and LOGANEnergy will present the scope of the PEM demonstration project and the installation plan to Diana Dean and the Civil Engineering staff. Any issues that cannot be resolved at the kickoff meeting will put the commencement of the installation on hold until the base POC submits a statement in writing that the project is ready to begin.

14.0 Status/Timeline

Please see Appendix Section 3 below.

Appendix

Section 1
Sample form used to qualify the fuel cell for initial start and the project acceptance test.

Installation / Acceptance Test Report

Site: U.S. Air Force Academy, CO

Installation Check List

TASK	Initials	DATE	TIME (hrs)
Batteries Installed	WH		
Stack Installed	WH		
Stack Coolant Installed	WH		
Air Purged from Stack Coolant	WH		
Radiator Coolant Installed	WH		
Air Purged from Radiator Coolant	WH		
J3 Cable Installed	WH		
J3 Cable Wiring Tested	WH		
Inverter Power Cable Installed	WH		
Inverter Power Polarity Correct	WH		
RS 232 /Modem Cable Installed	WH		
DI Solenoid Cable Installed with Diode	WH		
Natural Gas Pipe Installed	WH		
DI Water / Heat Trace Installed	WH		
Drain Tubing Installed	WH		

Commissioning Check List and Acceptance Test

TASK	Initials	DATE	TIME (hrs)
Controls Powered Up and Communication OK	WH		
SARC Name Correct	WH		
Start-Up Initiated	WH		
Coolant Leak Checked	WH		
Flammable Gas Leak Checked	WH		
Data Logging to Central Computer	WH		
System Run for 8 Hours with No Failures	WH		

Appendix Section 2

Plug Power GenSys5C Specifications


Plug Power GenSys 5C

- Dimensions 84 1/2" x 32" x 68 1/4"

- Performance Continuous Power Rating 5kWe (9kWth)
  Power Output 2.5-5kWe (3-9kWth)
  Voltage 120/240 VAC @ 60Hz
  Power Quality IEEE 519, Grid Interconnect IEEE P1547
  Emissions NOX <1ppm...SOX <1ppm
- Noise <60 dBa @ 1 meter
- Operating Conditions Temperature 0°F to 104°F
- Elevation 0 to 6000 feet
- Installation Outdoor
- Electrical Connection, Grid Parallel/Grid Independent
- Fuel, Natural Gas
- Certifications Power Generation, CSA International
- Power Conditioning UL 1741— Electromagnetic Compliance FCC Class B —

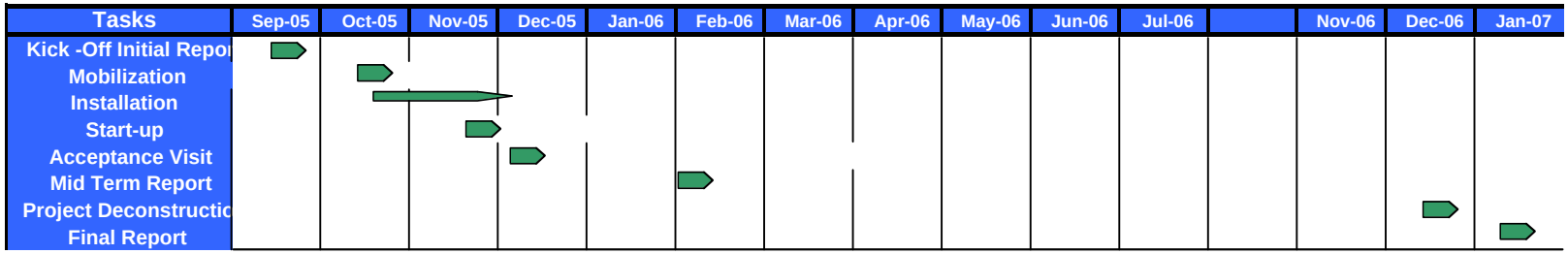
Appendix Section 3

Air Force Academy PEM Fuel Cell Demonstration Project

Installation, Monitoring, Performance Evaluations, & Reproting on One Plug Power PEM Fuel Cell At US Air Force Academy

Column Headings Indicate the Beginning of Each Month

Installation Schedule



Section 4

DOD FUEL CELL PROJECT KICKOFF MEETING AGENDA

Date:

Location:

ATTENDEES	ORG.	PHONE	CELL	EMAIL

Status

1. Introduction – All (*5 mins*)

2. Background & Expectations of PEM demonstration Program – CERL (*5 mins*)

3. Introduction to Project Team – LOGANEnergy (*10 mins*)

4. Fuel Cells System Project Description – LOGANEnergy – (*20-30 mins*)
   - Technology Overview OK OPEN
   - Project Installation Plan OK OPEN
   - Project Management Plan OK OPEN
   - Data Reporting and Communications OK OPEN
   - Environmental, base access and other security issues OK OPEN

5. Unresolved issues…POC approval – (*5-10 mins*) OK OPEN

6. Site Tour – *(N/A – Teleconference Meeting)*